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Project Summary

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Supplement to EPA/600/4-84/041: Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air (Revised 9/86)

R. M. Riggin, W. T. Winberry, Jr., and N. V. Tilley

This supplement was developed to expand upon the original compendium (4/84), which covered twenty-nine (29) air toxics that could be analyzed by five (5) general methods. The supplement now increases the number of air toxics to thirty-six (36) and the number of procedures to nine (9). The Compendium was developed to complement a previously published document entitled "Technical Assistance Document (TAD) for the Determination of Toxic Organic Compounds in Ambient Air." The compendium provides a standardized format for analytical procedures used in determining toxic compounds in ambient air. Further supplements to the Compendium will occur as suitable procedures become available. The current methods may also be modified as advancements are made.

The compendium sampling procedures range from utilizing liquid impingers to cryogenic trapping to adsorbent technology. Likewise, analytical procedures range from on-line gas chromatography (GC) to high resolution gas chromatography/high resolution mass spectroscopy (HRGC/HRMS) techniques. Consequently, many toxic organic compounds can be sampled and analyzed by several techniques, often with different interferences and detection limitations. This allows the user latitude in selection so as to complement his background and laboratory capability.

This Project Summary was developed by EPA's Environmental Monitoring Systems Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

Toxic air pollutants have been of concern for many years, primarily under Section 112 of the Clean Air Act, which establishes procedures for designating National Emission Standards for Hazardous Air Pollutants (NESHAP). NESHAPs are intended to provide control of source categories which emit pollutants that "may reasonably be anticipated to result in an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness."

Likewise, public concern for protection from exposure to toxic substances has intensified over the last decade. Evidence of the presence of these substances in ambient air across the United States has been increasing for some time. Although many of these substances are presently controlled

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through occupational, consumer protection, water or waste disposal regulations, control of air pollution involving specific toxic substances has been limited. This is due, in part, to a lack of information on ambient air levels and the uncertainty of the sampling and analysis methods for their detection.

Over the last several years, State and local air pollution control agencies have increased their efforts to measure the concentrations of toxic pollutants in ambient air. These activities have included monitoring around abandoned hazardous waste dump sites and solid waste landfills, as well as other point source and urban area monitoring. For the most part, network design, siting and sampling/analysis procedures used were based on professional judgments rather than adherence to any documented, uniform procedures and guidelines. The absence of standardized procedures raises serious concerns about the adequacy of the data collected for their intended uses. Ensuring data adequacy is critical, since major decisions on control actions, health effects, and other significant issues could be based on the interpretation of such data.

The objective of this project was to develop a compendium that would provide regional, state and local environmental regulatory agencies with specific guidance on sampling and analytical procedures, in a standardized format, for selected toxic organic compounds.

Structure of the Compendium

The current compendium consists of nine (9) procedures covering thirty-six (36) organic toxic compounds. Each procedure is written to be used independently from the others and is divided into twelve (12) sections entitled:

- Scope
- Applicable Documents
- Summary of Method
- Significance
- Definitions
- Interferences
- Apparatus
- Reagents/Materials
- Assembly/Calibration
- Sampling
- Analysis
- Performance Criteria and Quality Assurance

The procedures are written in a standardized format used by the American Society for Testing and Materials (ASTM). Each procedure has been identified with a revision number and dated to allow future modifications. Additional procedures, which may be compound-specific or of multiple analyte design, will be placed in the compendium as they become available.

Nearly all the procedures have some flexibility. Consequently, users are responsible for preparing certain standard operating procedures (SOPs) to be employed in their particular laboratory. Each procedure indicates those operations for which SOPs are required.

Table 1 lists the procedures contained in the compendium and Table 2 presents a partial listing of toxic organic compounds which can be determined using those procedures. Many of the procedures may be used to determine other toxic organics not indicated in Table 2. The user must be cautioned to evaluate the applicability of the method for that specific organic toxicant in advance.

Table 1. *List of the Procedures Presently in the Compendium*

Procedure Number	Description	Types of Compounds Determined
TO-1	Tenax GC Adsorption and GC/MS Analysis	Volatile, nonpolar, organics (e.g., aromatic hydrocarbons, chlorinated hydrocarbons) having boiling points in the range of 80° to 200°C.
TO-2	Carbon Molecular Sieve Adsorption and GC/MS	Highly volatile, nonpolar organics (e.g., vinyl chloride, vinylidene chloride, benzene, toluene) having boiling points in the range of −15° to +120°C.
TO-3	Cryogenic Trapping and GC/FID or ECD Analysis	Volatile, nonpolar organics having boiling points in the range of −10° to +200°C.
TO-4	High Volume PUF Sampling and GC/ECD Analysis	Organochlorine pesticides and PCBs.
TO-5	Dinitrophenylhydrazine Liquid Impinger Sampling and HPLC/UV Analysis	Aldehydes and Ketones
TO-6	High Performance Liquid Chromatography (HPLC)	Phosgene
TO-7	Thermosorb/N Adsorption	N-Nitrosodimethylamine
TO-8	Sodium Hydroxide Liquid Impinger Sampling with High Performance Liquid Chromatography (HPLC) Analysis	Cresols/Phenols
TO-9	High Volume Polyurethane Foam Sampling with High Resolution Gas Chromatography/High Resolution Mass Spectrometry (HRGC/HRMS) Analysis	Dioxins

Table 2. *Applicability of Specific Procedure to Selective Toxic Organics*

Compound	Applicable Procedure
Acetaldehyde	TO-5
Acrolein	TO-5
Acrylonitrile	TO-2, TO-3
Allyl Chloride	TO-2, TO-3
Benzaldehyde	TO-5
Benzene	TO-1, TO-2, TO-3
Benzyl Chloride	TO-1, TO-3
Carbon Tetrachloride	TO-2, TO-3
Chlorobenzene	TO-1, TO-3
Chloroform	TO-2, TO-3
Chloroprene (2-Chloro-1, 3-Butadiene)	TO-1, TO-3
Cresol	TO-8
4,4'-DDE	TO-4
4,4'-DDT	TO-4
1,4-Dichlorobenzene	TO-1, TO-3
Dioxin	TO-9
Ethylene dichloride (1,2-Dichloroethane)	TO-2, TO-3
Formaldehyde	TO-5
Methyl Chloroform (1,1, 1-Trichloroethane)	TO-2, TO-3
Methylene Chloride	TO-2, TO-3
Nitrobenzene	TO-1, TO-3
N-Nitrosodimethylamine	TO-7
Perchloroethylene (Tetrachloroethylene)	TO-1, TO-3
Phenol	TO-8
Phosgene	TO-6
Polychlorinated Biphenyls (PCBs)	TO-4
Propanol	TO-5
Toluene	TO-1, TO-2, TO-3
Trichloroethylene	TO-1, TO-2, TO-3
Vinyl Chloride	TO-2, TO-3
Vinylidine Chloride (1,1-dichloroethene)	TO-3, TO-3
o,m,p-Xylene	TO-1, TO-3

R. M. Riggin was formally with Battelle-Columbus Laboratories, Columbus, OH 43201 693; William T. Winberry, Jr., and Norma Tilley are with Engineering Science, Cary, NC 27511.
L. J. Purdue and H. G. Richter are the EPA Project Officers (see below).
The complete report and the most recent supplement are entitled:
"Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air," (Order No. PB 87-168 688/AS; Cost: $18.95)
"Supplement to EPA/600/4-84/041: Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air," (Order No. PB 87-168 696/AS; Cost: $18.95)
The above reports will be available only from: (cost subject to change)
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: 703-487-4650
The EPA Project Officers can be contacted at:
Environmental Monitoring Systems Laboratory
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711

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